

INTRODUCTION TO BRAKING SYSTEM



BRAKE

- ▶ A brake is a mechanical device which inhibits motion.



WORKING OF BRAKES

- A COMMON MISCONCEPTION ABOUT BRAKES IS THAT BRAKES SQUEEZE AGAINST A DRUM OR DISC, AND THE PRESSURE OF THE SQUEEZING ACTION SLOWS THE VEHICLE DOWN. THIS IS IN FACT A PART OF THE REASON FOR SLOWING DOWN A VEHICLE.
- ACTUALLY BRAKES USE FRICTION OF BRAKE SHOES AND DRUMS TO CONVERT KINETIC ENERGY DEVELOPED BY THE VEHICLE INTO HEAT ENERGY.
- WHEN WE APPLY BRAKES, THE PADS OR SHOES THAT PRESS AGAINST THE BRAKE DRUMS OR ROTOR CONVERT KINETIC ENERGY INTO THERMAL ENERGY VIA FRICTION.

THUS BRAKES ARE ESSENTIALLY A
MECHANISM TO CHANGE ENERGY
TYPES

TYPES OF BRAKES

➤ MECHANICAL BRAKES

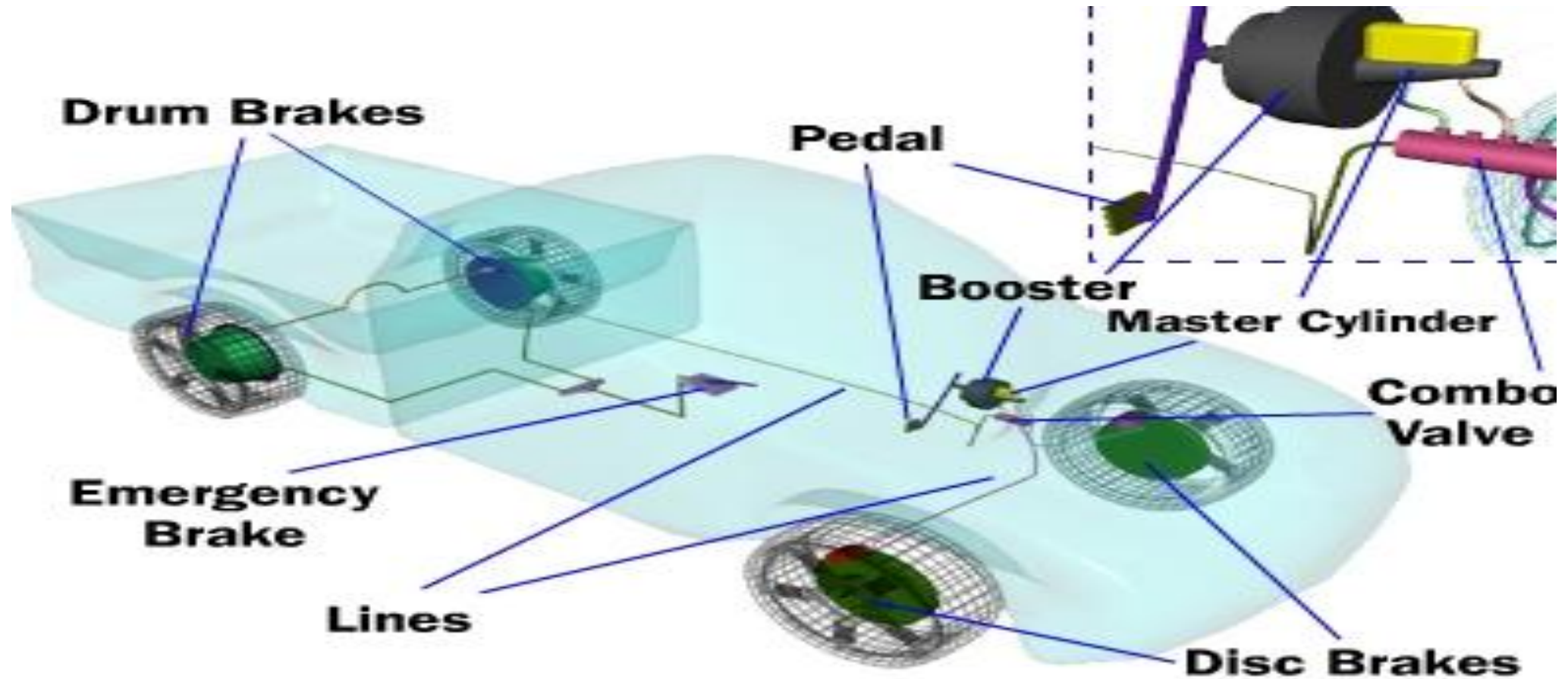
- DRUM BRAKES
- DISC BRAKES

➤ HYDRAULIC BRAKES

➤ POWER BRAKES

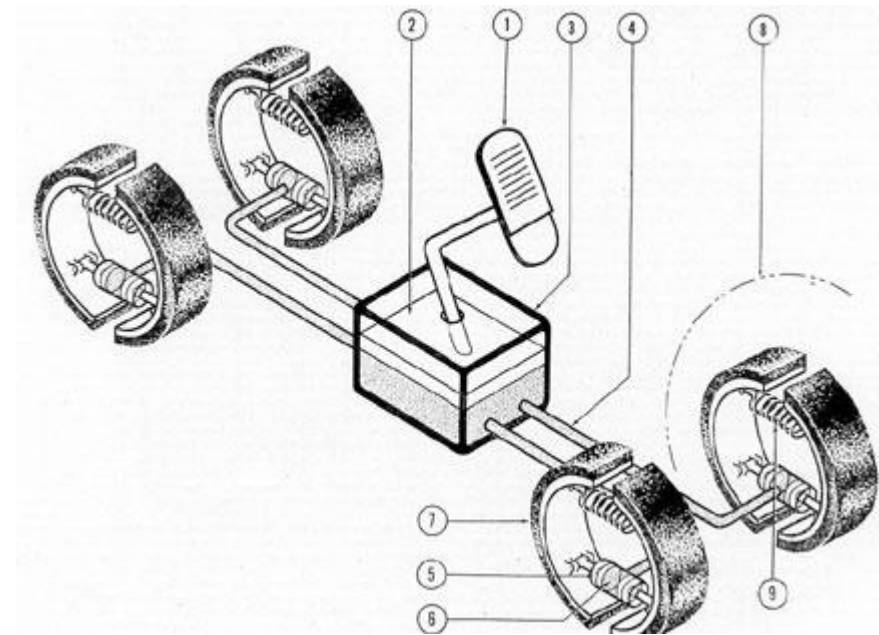
- AIR BRAKES
- AIR HYDRAULIC BRAKES
- VACCUM BRAKES
- ELECTRIC BRAKES

BRAKE SYSTEM COMPONENTS



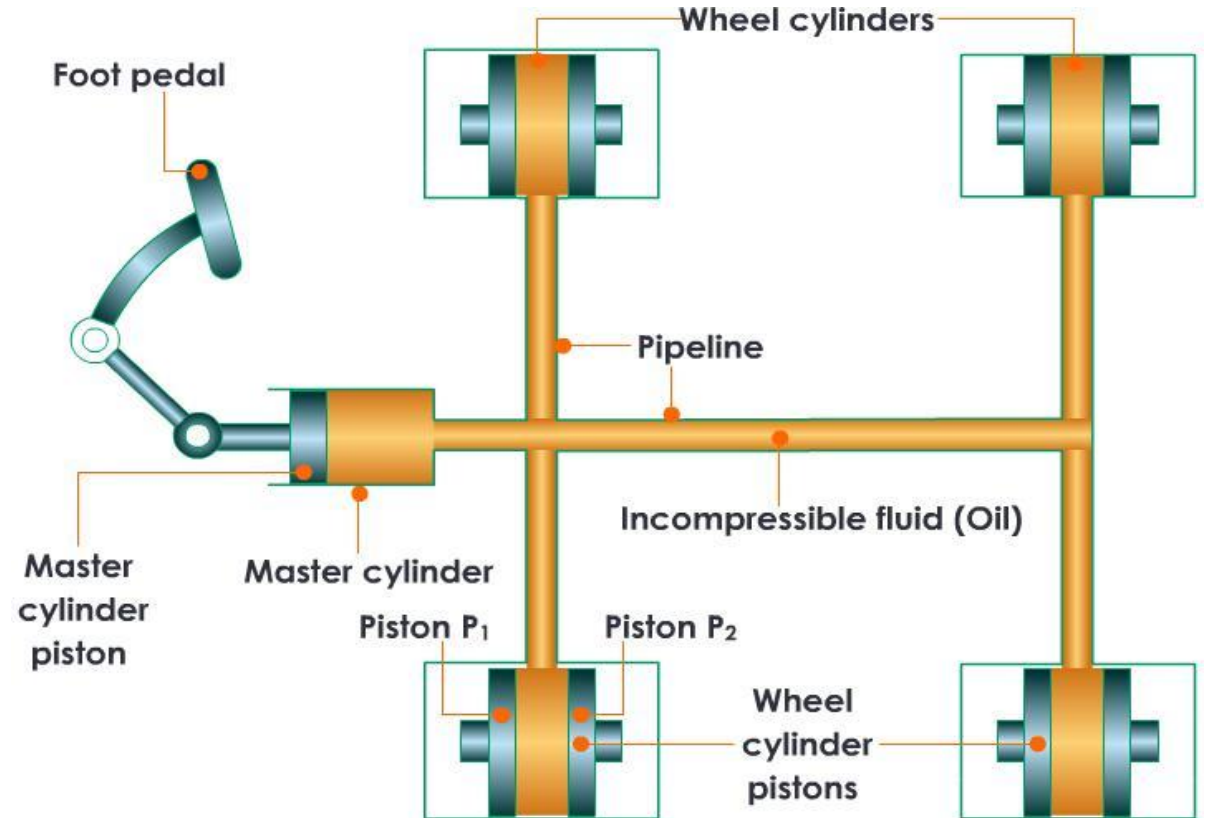
HYDRAULIC BRAKES

- ▶ Hydraulics is the use of a liquid under pressure to transfer force or motion, or to increase an applied force.
- ▶ The pressure on a liquid is called HYRAULIC PRESSURE.
- ▶ And the brakes which are operated by means of hydraulic pressure are called HYDRAULIC BRAKES.
- ▶ These brakes are based on the principle of Pascal's law.



PASCAL'S LAW

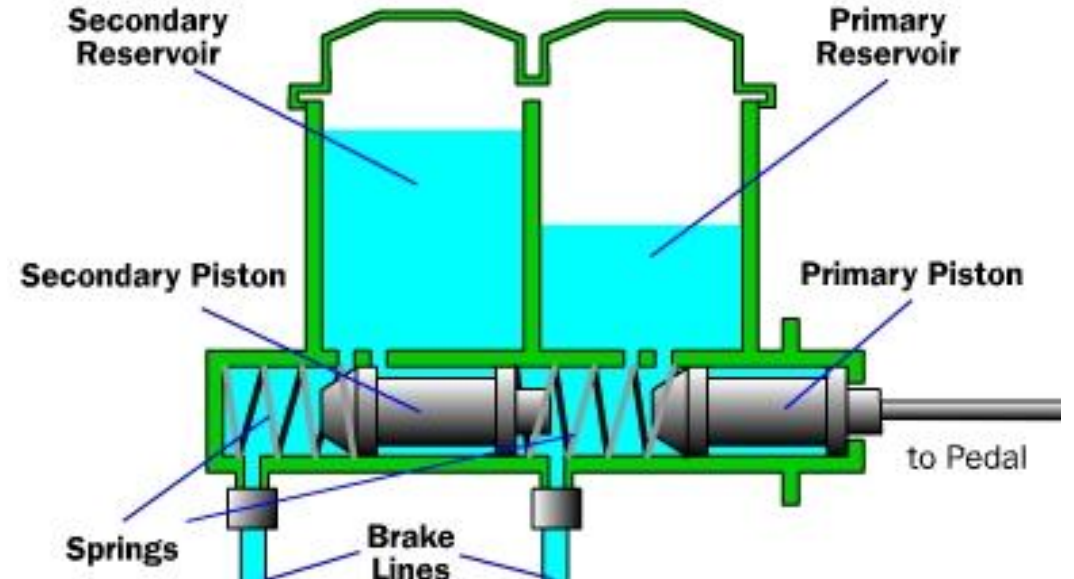
- The pressure exerted anywhere in a mass of confined liquid is transmitted undiminished in all directions throughout the liquid.
- Applied in hydraulic lifts, hydraulic brakes etc.



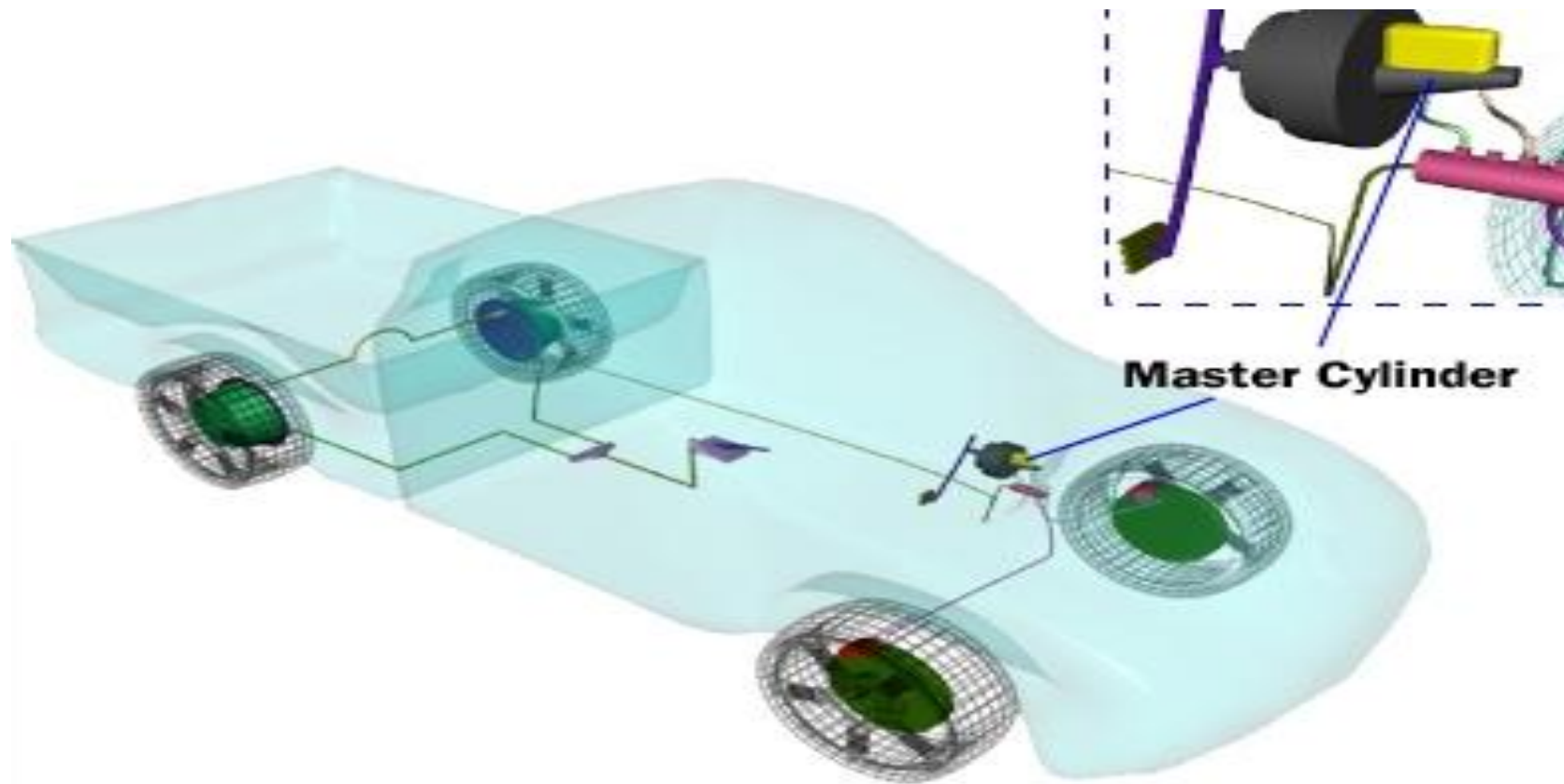
MASTER CYLINDER IN ACTION

- ▶ When we press the brake pedal, it pushes on primary piston through a linkage.
- ▶ Pressure is built in the cylinder and the lines as the brake pedal is depressed further.
- ▶ The pressure between the primary and secondary piston forces the secondary piston to compress the fluid in its circuit.
- ▶ If the brakes are operating properly, the pressure will be same in both the circuits.
- ▶ If there is a leak in one of the circuits, that circuit will not be able to maintain pressure.

Inside the Master Cylinder



MASTER CYLINDER



USE OF LIQUIDS INSTEAD OF GASES

- ▶ Liquids are used in hydraulic systems because liquids are incompressible.
- ▶ If we use a gas, on increasing the pressure, the gas will be compressed into a smaller volume due to which there will be no transmission of force or motion.

ADVANTAGES OF HYDRAULIC BRAKES

- ▶ Equal braking effort to all the four wheels
- ▶ Less rate of wear (due to absence of joints compared to mechanical brakes)
- ▶ Force multiplication (or divisions) very easily just by changing the size of one piston and cylinder relative to other.

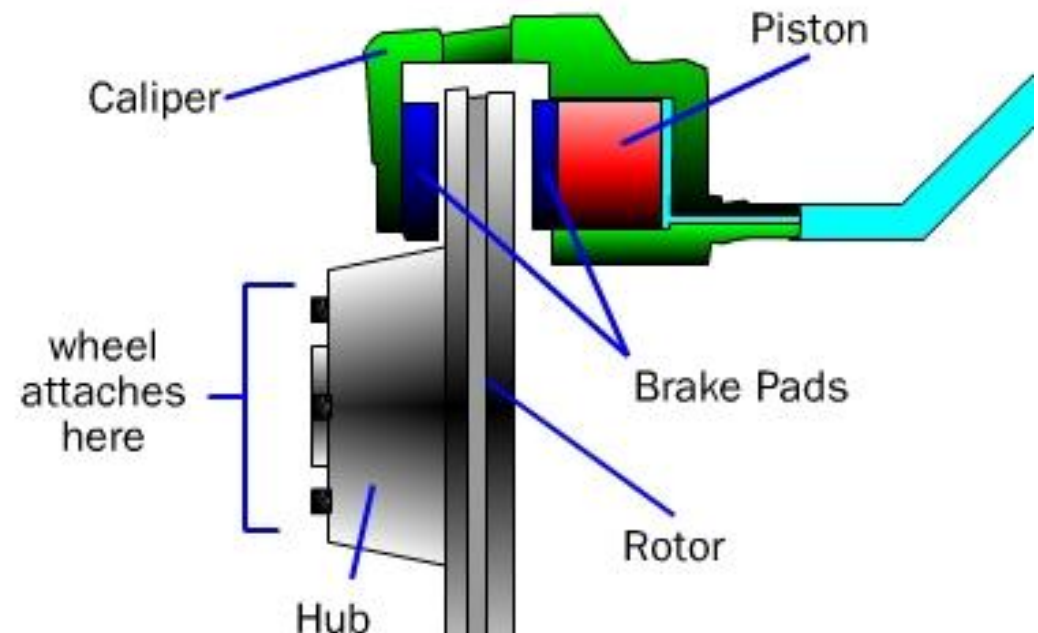
DISADVANTAGES OF HYDRAULIC BRAKES

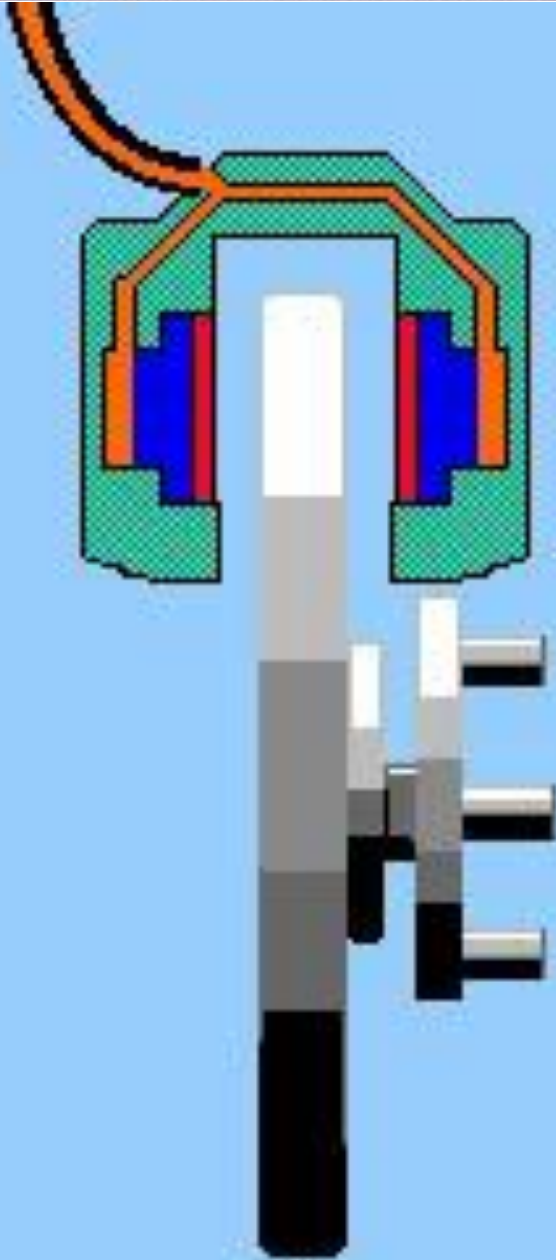
- ▶ Even slight leakage of air into the breaking system makes it useless.
- ▶ The brake shoes are liable to get ruined if the brake fluid leaks out.

DISC BRAKES

- ▶ In a disc brake, the fluid from the master cylinder is forced into a caliper where it presses against a piston.
- ▶ The piston in turn squeezes two brake pads against the disc (rotor), which is attached to wheel, forcing it to slow down or stop.

How a Disc Brake Works





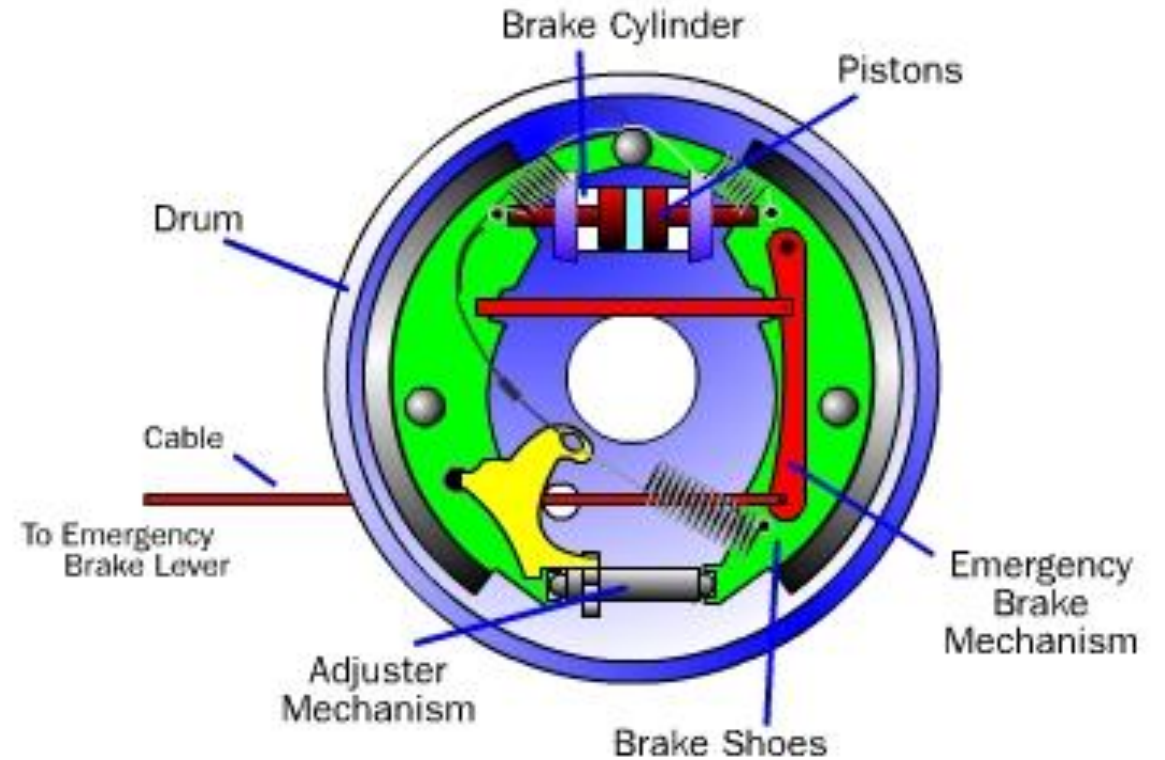
Two major braking systems are used in automobiles—drum brakes and disk brakes.

DISC BRAKE AND BRAKE OF A BICYCLE

- ▶ Similar to a bicycle brake where two rubber pads run against the wheel rim creating friction.
- ▶ But in a disc brake, the brake pads squeeze the rotor instead of the wheel, and the force is transmitted hydraulically instead of through a cable.

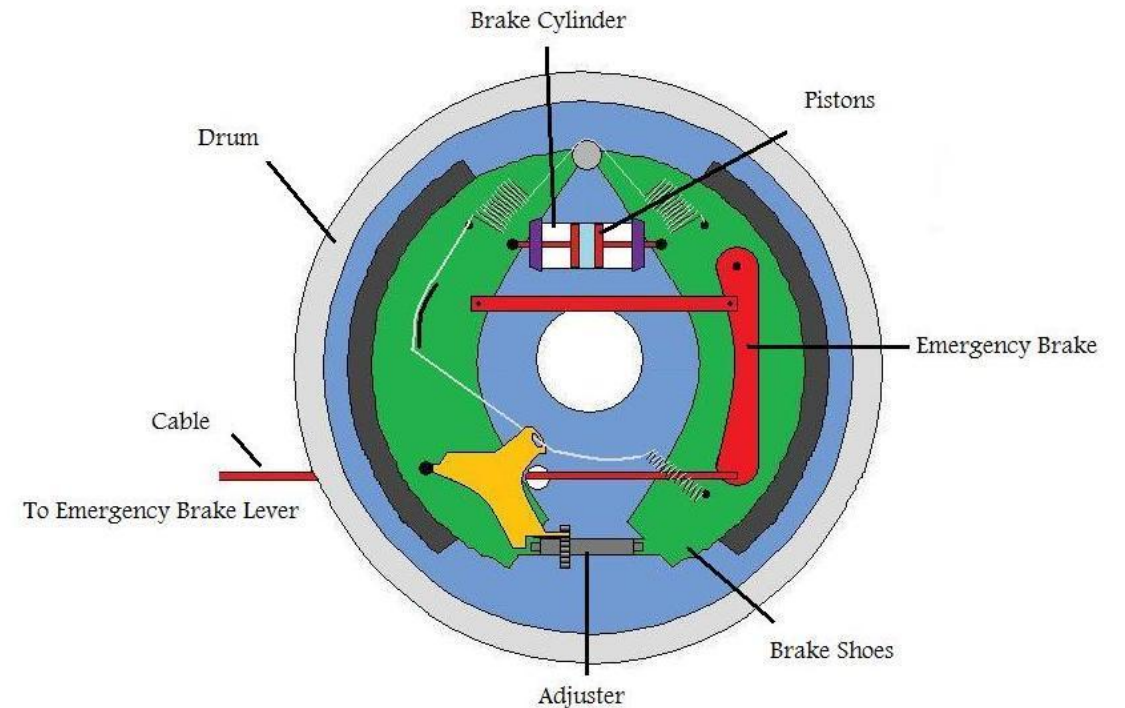
DRUM BRAKES

- ▶ The drum brake has a metal brake drum that encloses the brake assembly at each wheel.
- ▶ Two curved brake shoes expand outward to slow or stop the drum which rotates with the wheel.



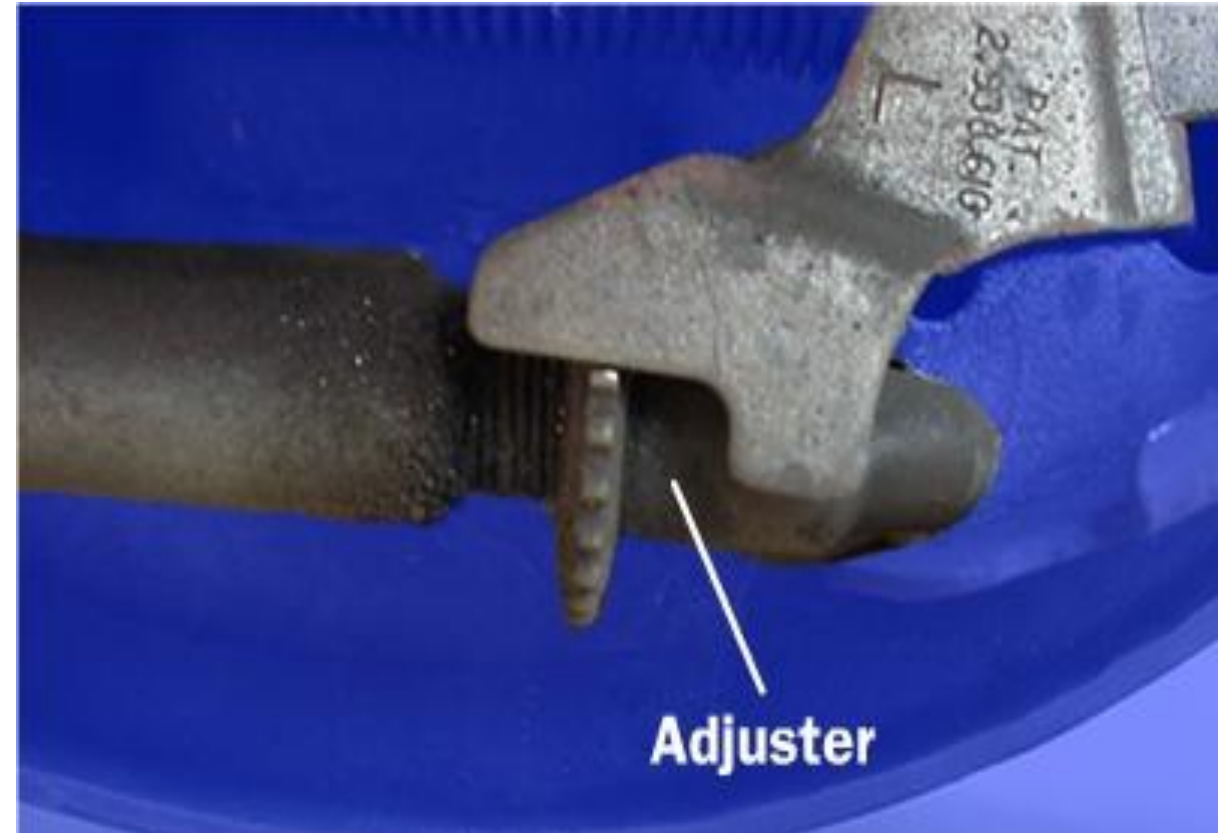
WORKING OF DRUM BRAKES

- ▶ Drum brakes work on the same principle as the disc brakes.
- ▶ Shoes press against a rotating surface.
- ▶ In this system that surface is called a drum.
- ▶ Drum brake also has an adjuster mechanism, an emergency brake mechanism and lots of springs.
- ▶ The shoes are pulled away from the drum by the springs when the brakes are released.



DRUM BRAKE ADJUSTER

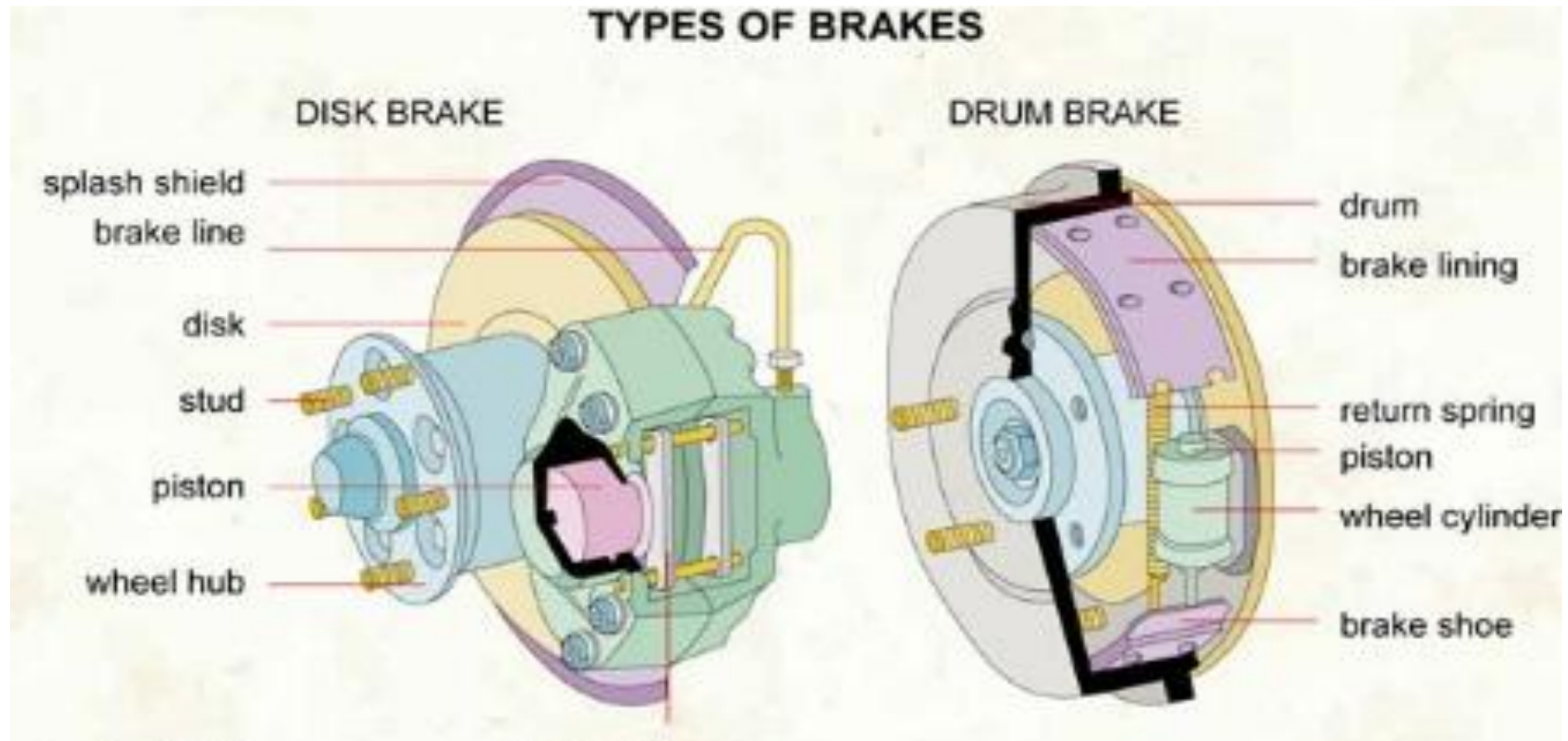
- ▶ For the drum brakes to function correctly, the brake shoes must remain close to drum without touching it.
- ▶ If they get too far away from the drum (as the shoes wear down), the piston will require more fluid to travel that distance and the brake pedal will sink closer to the floor when we apply brakes.
- ▶ That is why most drum brakes have an automatic adjuster.





DISK BRAKE AND DRUM BRAKE

TYPES OF BRAKES

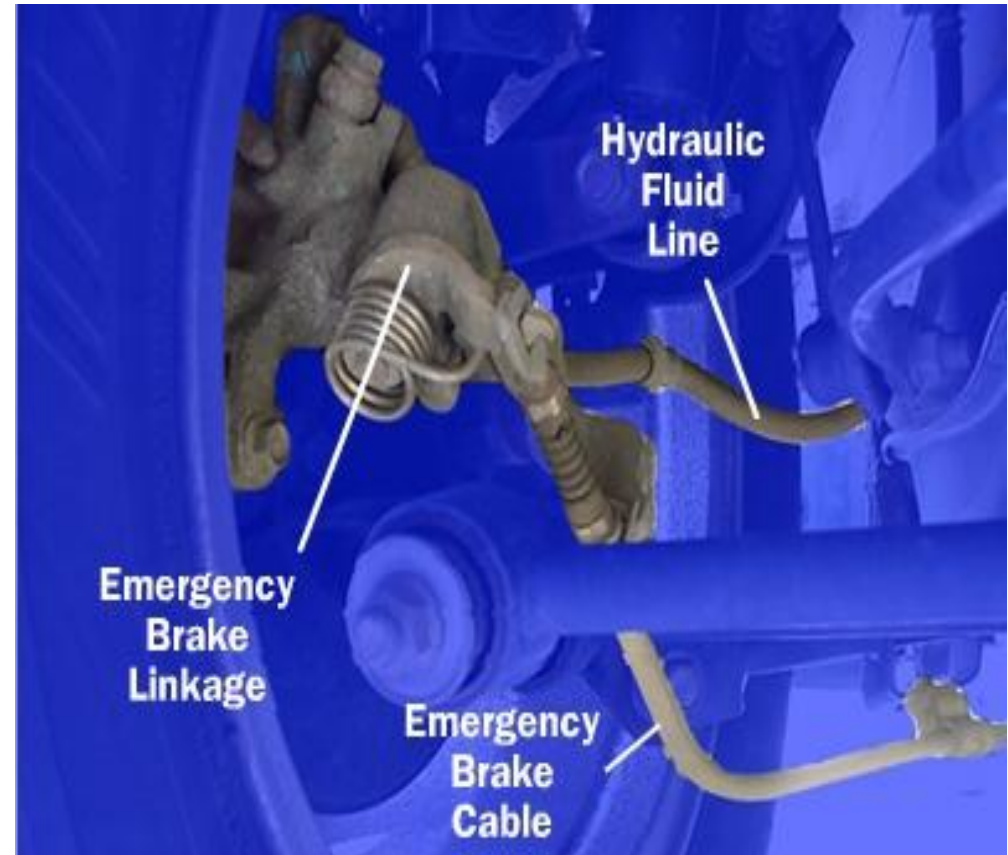


SOME MORE POINTS

- ▶ Most modern cars have disc brakes on front wheels and drum brakes on rear wheels and some wheels have disc brakes on all four wheels.
- ▶ To increase safety, most modern car brake systems are broken into two circuits, with two wheels on each circuit.
- ▶ If a fluid leak occurs in one circuit, only two of the wheels will lose their brakes and the car will still be able to stop when we press the brake pedal.

EMERGENCY BRAKES

- ▶ In cars with disc brakes on all four wheels, an emergency brake has to be actuated by a separate mechanism than the primary brakes in case of a total primary brake failure.
- ▶ Most cars use a cable to actuate the emergency brake.
- ▶ Some cars with four wheel disc breaks have a separate drum brake integrated into the hub of the rear wheels.
- ▶ This drum brake is only for emergency break system, and is actuated only by the cable. It has no hydraulics.

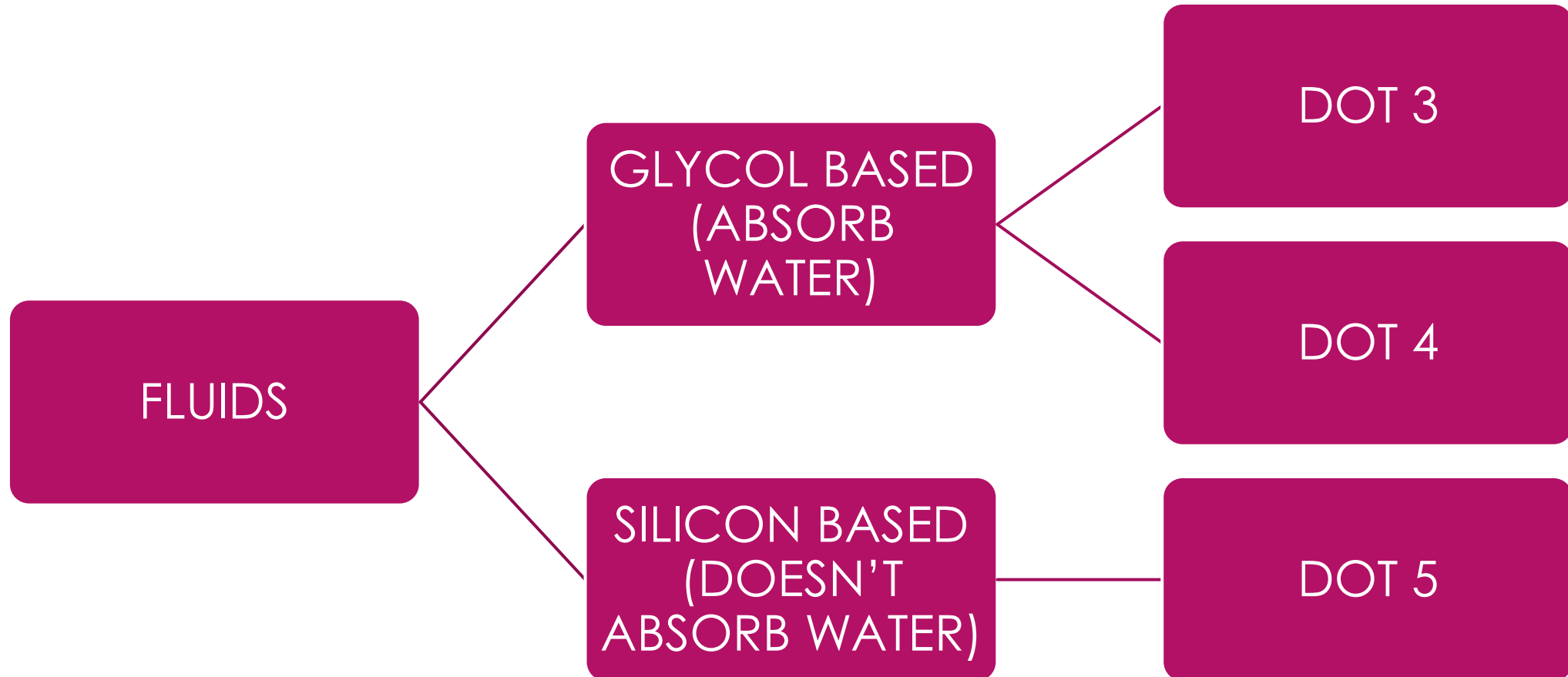


BRAKE FLUIDS

- ▶ One of the important characteristics of brake fluid is its BOILING POINT. Hydraulic systems rely on incompressible fluid to transmit force.
- ▶ Liquids are generally incompressible while gases are compressible.
- ▶ If the brake fluid boils (becomes a gas), it will lose most of its ability to transmit force.
- ▶ This may partially or completely disable the brakes.



TYPES OF BRAKE FLUIDS



PRECAUTIONS

- ▶ As a DOT 3 or DOT 4 brake fluid absorbs water, its boiling point decreases. It can absorb water from air, that is why we should avoid opening the car's brake fluid reservoir and the container of the brake fluid should be tightly sealed.
- ▶ Also DOT 3 and DOT 4 brake fluids eat paint.
- ▶ None of the different types of brake fluids should be mixed. They can react badly with each other and corrode the brake system.